DIMETHOATE PARTIAL HED CHAPTER

This ORE portion of the HED chapter is paged and set up as it appears in the HED document.

4. Occupational Exposure and Risk Characterization

a. Occupational Exposure

I. Summary of use patterns and formulations

Dimethoate is an organophosphate insecticide/acaricide that is used to control a wide variety of target pests including insects and related organisms, mollusks, fouling organisms and miscellaneous invertebrates. Some examples of the pests that dimethoate is intended to control include aphids, citrus thrips, grasshoppers, leafminers, spider mites, and whiteflies. Dimethoate currently has 138 active registrations, 86 of these registrations have been granted under Section 24 of FIFRA. Manufacturing products contain between 95 and 96% active ingredient. Formulated end-use products include: emulsifiable concentrates that range in concentration from 8-57% dimethoate, several wettable powder products that each contain 25% dimethoate, and a ready-to-use formulation that contains 30.5% dimethoate. Historically, several other types of formulated products have contained dimethoate, such as dusts and granulars. It is the understanding of EPA, however, that none of these other formulation types are being supported in the reregistration process. This summary is based on the *Label Use Information System (LUIS)* report for dimethoate and a review of the dimethoate file (November, 1997) in the *Reference Files System.*

Based on the available information, currently products containing dimethoate are intended for both the residential and occupational markets. However, since the registrants have indicated that they will not support residential use patterns during the reregistration process, no residential exposure and risk assessment is included in this document.

An analysis of the current labeling and available use information was completed (e.g., LUIS). In addition, information was received from one of the main registrants about use patterns likely to be supported for reregistration. The information indicates that dimethoate currently is available in a wettable powder formulation for a variety of uses; however this formulation type will be supported during reregistration for use only on grapes. The information from the registrant also indicates that dimethoate currently is available in a ready-to-use formulation; however this formulation type will not be supported during reregistration.

The information indicates that dimethoate can potentially be used on the following sites and that these sites definitely are being supported during reregistration:

- *Food/Feed/Fiber Crops*: broccoli, Brussels sprouts, cabbage, cauliflower, collards, kale, mustard greens, corn, sorghum, wheat, grapefruit, lemons, oranges, tangerines, melons, watermelons, peppers, tomatoes, peas, beans (excluding cowpeas), lentils, soybeans, celery, endive, escarole, head and leaf lettuce, spinach, Swiss chard, alfalfa, pears, apples, potatoes, turnips grapes, cherries, pecans, cotton, and safflower. *Ornamental Crops:* arborvitae, azalea, birch, boxwood, camellia, carnation, cedar, Christmas trees, citrus trees (non-bearing nursery stock), cypress, daylilies, Douglas fir, elaegnus, elm, euonymus, Ficus nitida, gardenia, gerbera, gladiolus, hemlock, holly (American, English) iris, juniper, oak, pine, pinyon pine, poinsettia, pyracantha, roses, taxus (yew), viburnum.

The information indicates that dimethoate currently can be potentially used on the following sites; however these uses may not be supported during reregistration:

- *Ornamental Uses:* hackberry, honeysuckle

- *Forestry Uses*

- *Rights-of-Way Uses:* currently registered only in California

- *Uses in and around Residences or Recreation Areas:* including households/domestic dwellings, pet living and sleeping quarters,

- *Uses in and around Animal/Livestock Quarters*

- *Uses on Meat or Dairy Animals*

- *Uses in Outdoor Commercial/Institutional/Industrial Premises:* including loading docks, and warehouses

- *Uses on Outdoor Refuse or Solid Waste:* including refuse areas, manure piles, and garbage dumps

- *Uses for Sewage Systems*

The information indicates that dimethoate currently can be potentially used with the following equipment; however these uses may not be supported during reregistration:

- *Chemigation*

- *High Pressure Handwand*

- *Sprinkler Can*

- *Ultra Low Volume Aerial*: less than two gallons of finished spray per acre

In addition to reviewing and summarizing the use information available from within the agency (e.g., LUIS and labels), EPA also reviewed the following two documents that document the use patterns for Dimethoate:

- *Dimethoate Use Information:* Authored by Blane Dahl of Jellinek, Schwartz, and Connolly (5/21/97); and

- *Dimethoate Usage Report:* Authored by P. Leanne Pruett (5/30/96).

These documents were essentially found to agree with the information that serves as the basis for the handler exposure/risk assessment presented in this document. Much of the unique information included in these documents was not required for the handler exposure assessment.

ii. Handler exposure scenarios and assumptions

EPA has determined that exposure to pesticide handlers is likely during the use of dimethoate in occupational settings. The anticipated use patterns and current labeling indicate 16 major occupational exposure scenarios based on the types of equipment that potentially can be used to make dimethoate applications. These 16 scenarios serve as the basis for the quantitative exposure/risk assessment developed for handlers in the occupational setting. These include the following:

(1a) mixing/loading liquids for aerial or chemigation (if retained) application;
(1b) mixing/loading liquids for groundboom application;
(1c) mixing/loading liquids for airblast sprayer application;

(2a) mixing/loading wettable powders for aerial application or chemigation (if retained) applications;
(2b) mixing/loading wettable powders for groundboom application;
(2c) mixing/loading wettable powders for airblast sprayer application;
(2d) mixing/loading wettable powders for right-of-way application (if retained);
(3) applying sprays with aircraft;
(4) applying sprays with helicopter;
(5) applying sprays using a groundboom sprayer;
(6) applying liquids using a paintbrush;
(7) applying sprays using an airblast sprayer;
(8) applying ready-to-use liquids;
(9) applying sprays to right-of-ways;
(10) mixing/loading/applying sprays using soil injection;
(11) mixing/loading/applying sprays using a backpack;
(12) mixing/loading/applying sprays using a low pressure hand wand;
(13) mixing/loading/applying sprays using a high pressure hand wand;
(14) mixing/loading/applying sprays using a sprinkler can;
(15) mixing/loading/applying sprays using a soil drench device; and
(16) flagging during aerial application.

The following assumptions and factors were used in order to complete this exposure assessment:

- Average body weight of an adult handler is 70 kg. This body weight is used in the short-term and intermediate-term assessments, since the endpoints of concern are not gender-specific (i.e., the cholinesterase inhibition could be assumed to occur in males or females).

- The number of acres treated or volume of spray solution applied per day are specific to each equipment type addressed in the exposure assessment and are representative of the amount that can be treated/applied in a single 8 hour workday for each exposure scenario.

- Daily areas and volumes (as appropriate) to be treated in each occupational exposure scenario include: 350 acres for aerial and chemigation applications; 80 acres for groundboom applications in an agricultural setting; 40 acres for airblast applications in an agricultural setting; 10 acres for right-of-way applications; 2 gallons for paint-on agents; 1000 gallons for high pressure handwand applications; 40 gallons for backpack sprayers; and 40 gallons for low pressure handwands. No data or volumes were estimated for the ready-to-use product, soil drench method, soil injection method, or sprinkler can method because scenario-specific exposure data are not available and use information describing these techniques in sufficient detail were not available.

- The following are the maximum use rates being supported for reregistration by at least one registrant. (Note: since other registrants, including IR-4 and States may support other crops (i.e., Brussels sprouts), higher use rates, and other formulations and equipment, the risk assessment also contains the current formulations, equipment types, and use rates.)

-- At 2.0 lb/A wettable powder formulation: grapes
-- At 1.0 lb/A emulsifiable concentrate formulation: citrus (soil drench)
-- At 0.67 lb/A emulsifiable concentrate formulation: wheat
-- At 0.5 lb/A emulsifiable concentrate formulation: broccoli, cabbage, cauliflower, field corn, sorghum, citrus (foliar applications), melons, watermelons, tomatoes, beans (excluding cowpeas), lentils, soybeans, celery, alfalfa, pears, apples, potatoes, cotton, and safflower
-- At 0.33 lb/A emulsifiable concentrate formulation: peppers, cherries, and pecans
-- At 0.25 lb/A emulsifiable concentrate formulation: collards, kale, mustard greens, endive (escarole), head lettuce, leaf lettuce, spinach, swiss chard, and turnips
-- At 0.16 lb/A emulsifiable concentrate formulation: peas

- Calculations are completed at the maximum application rates for a variety of crops recommended by the available dimethoate labels to bracket risk levels associated with the various use patterns.

- Due to a lack of scenario-specific data, EPA calculates unit exposure values using generic protection factors that are applied to represent various risk mitigation options (i.e., the use of personal protective equipment (PPE) and engineering controls). PPE protection factors include those representing double layers of clothing (50%), chemical-resistant gloves (90%), and respiratory protection (80 to 90% depending upon mitigation selected). Engineering controls are generally assigned a protection factor of 90% or higher. Engineering controls may include closed mixing/loading systems and enclosed cabs/cockpits.

iii. Handler Exposure Assessment

The following document, evaluating handler exposures in various ground and aerial application scenarios, was submitted in support of the reregistration of dimethoate:

- *Preliminary Analysis of Human Exposure to Dimethoate:* EPA MRID NR409494-01; Authored by P.R. Datta; Report Issue Date 7/14/78.

This document included calculations that addressed the dermal and inhalation exposure routes for occupational handlers of dimethoate. However, the document did not contain any chemical-specific data generated under FIFRA data requirements/guidelines in support of the reregistration of dimethoate. The *Pesticide Handlers Exposure Database (PHED)* was not utilized as a source for any surrogate data in this registrant-submitted assessment because it was completed prior to the existence of PHED. The authors selected the following two literature references to serve as the basis for this assessment:

- *Exposures to Pesticides in Agriculture, A Survey of Spraymen Using Dimethoate in the Sudan:* Copplestone JF, Fakhri ZI, Miles JW, Mitchell CA, Ostman Y, and Wolfe HR; Bull. World Health 54:217-223, 1976.

- *Parathion Exposures in Agricultural Spray Pilots and Ground Crews:* Gordon M, Cohen B, Richter E, Luria M, and Schoenberg J; Environ. Med. & Physiol. May 8-11, pages 17-19, 1978.

The registrant-submitted assessment addressed a variety of dimethoate exposure scenarios based on uses ranging from typical agricultural crops (e.g., citrus, grapes, corn, pecans, tobacco, apples and cotton) to uses in livestock facilities, veterinary offices, forestry, and in commercial ornamental propagation.

At this time, the registrant submission is unacceptable for incorporation into the handler exposure assessment completed by EPA because the data upon which it is based were not generated in accordance with FIFRA requirements (e.g., *Good Laboratory Practices* and the *Pesticide Assessment Guidelines)*. Additionally, EPA uses PHED as a primary source of surrogate exposure data because the data contained in the system have undergone an extensive quality control/quality assurance review process as has the system itself (i.e., values calculated using PHED can be considered reliable based on the data included in the system).

As no acceptable chemical-specific handler exposure data were submitted in support of the reregistration of dimethoate, an exposure assessment for each use scenario was developed, using surrogate values calculated using the *Pesticide Handlers Exposure Database (V 1.1).* PHED data were used to complete an assessment only for those scenarios where the surrogate data were deemed appropriate. PHED was designed by a task force consisting of representatives from the U.S. EPA, Health Canada, the California Department of Pesticide Regulation, and member companies of the American Crop Protection Association. PHED is a generic database containing measured exposure data for workers involved in the handling or application of pesticides in the field (i.e., currently contains data for over 2000 monitored exposure events). The basic assumption underlying the system is that exposure to pesticide handlers can be calculated using the monitored data as exposure is primarily a function of the physical parameters of the handling and application process (e.g., packaging type, application method, and clothing scenario). PHED also contains algorithms that allow the user to complete surrogate task-based exposure assessments beginning with one of the four main data files contained in the system (i.e., mixer/loader, applicator, flagger, and mixer/loader/applicator).

Users can select data from each major PHED file and construct exposure scenarios that are representative of the use of the chemical. However, to add consistency to the risk assessment process, the EPA in conjunction with the PHED task force has evaluated all data within the system and developed a surrogate exposure table that contains a series of standard unit exposure values for various occupational exposure scenarios (*PHED Surrogate Exposure Guide of May, 1997*). These standard unit exposure values are the basis for this assessment. The standard exposure values (i.e., the unit exposure values included in the exposure and risk assessment tables) are based on the "best fit" values calculated by PHED. PHED calculates "best fit" exposure values by assessing the distributions of exposures for each body part included in datasets selected for the assessment (e.g., chest or forearm) and then calculates a composite exposure value representing the entire body. PHED categorizes distributions as normal, lognormal, or in an "other" category. Generally, most data contained in PHED are lognormally distributed or fall into the PHED "other" distribution category. If the distribution is lognormal, the geometric mean for the distribution is used in the calculation of the "best fit" exposure value. If the data are an "other" distribution, the median value of the dataset is used in the calculation of the "best fit" exposure value. As a result, the surrogate unit exposure values that serve as the basis for this assessment generally range from the geometric mean to the median of the selected dataset.

Occupational handler exposure assessments are completed by the EPA using a baseline exposure scenario and, if required, increasing levels of risk mitigation (PPE and engineering controls) to achieve an appropriate margin of exposure or cancer risk. The baseline clothing/PPE ensemble for occupational exposure scenarios is generally an individual wearing long pants, a long-sleeved shirt, no chemical-resistant gloves (there are exceptions pertaining to the use of gloves and these are noted), and no respirator.

The exposure/risk assessment that has been completed for the occupational handler scenarios is presented in Appendices D through F. Occupational handler scenarios were assessed using the short and intermediate-term endpoints deemed appropriate for dermal exposure. The short-term dermal endpoint is a NOAEL of 10 mg/kg/day based on a 5-day dermal study. No dermal absorption adjustment is required since the endpoint is based on a dermal study. The short-term inhalation endpoint is a NOAEL of 2 mg/kg/day based on an oral acute neurotoxicity and 2- to 90-day oral subchronic study. Absorption is assumed to be 100 percent. The Uncertainty Factor for both short-term endpoints is 100; 10X for intraspecies variability and 10X for interspecies extrapolation.

The intermediate-term dermal endpoint is an LOAEL of 3.2 mg/kg/day based on an oral subchronic neurotoxicity study in rats and a subchronic oral study. Dermal absorption is assumed to be 11% for the purposes of risk assessment. The intermediate-term inhalation endpoint is an LOAEL of 3.2 kg/kg/day based on a 2- to 90-day oral subchronic rat study. Absorption is assumed to be 100 percent. The Uncertainty Factor for both intermediate-term endpoints is 300; 10X for intraspecies variability, 10X for interspecies extrapolation and 3X for the use of an LOAEL rather than a NOAEL.

EPA anticipates that occupational dimethoate exposures will only occur in a short-term or intermediate-term pattern. EPA anticipates that occupational exposures will not be chronic because EPA defines chronic exposures as use of the chemical on every working day and it is anticipated that dimethoate, as with other typical pesticide compounds, will not be used on every working day.

The calculation of baseline total daily dose levels (mg/kg/day) that include dermal and inhalation exposures are presented in Appendix D for all occupational handler exposure scenarios.

The total daily dose levels presented in Appendix D were then used to calculate *Margins of Exposure (MOEs)* for baseline attire using the short and intermediate-term toxicological endpoints (Appendix D). In Appendix E, MOEs were calculated, when necessary, using personal protective equipment in addition to baseline attire. In Appendix F, MOEs were calculated, when necessary, using engineering controls. Appendix H summarizes the caveats and parameters specific to the surrogate data used for each exposure scenario and corresponding exposure/risk assessment. These caveats include the source of the data and an assessment of the overall quality of the data. The assessment of data quality is based on the number of observations and the available quality control data. The quality control data are assessed based on a grading criteria established by the PHED task force. Additionally, it should be noted that all calculations were completed based on current EPA policies pertaining to the completion of occupational exposure/risk assessments (e.g., rounding and acceptable data sources).

iv. Calculating Dose From Dermal and Inhalation Exposure

The methods used to calculate daily dose (mg/kg/day) resulting from dermal and inhalation exposures to dimethoate handlers are presented below.

Daily dermal dose is calculated using the following formula [Note: The same formula is applied regardless of the risk mitigation level. Only the unit exposure levels vary with different levels of risk mitigation.]:

$$D_{\text{Daily Dermal}} = (UE \times AR \times A \times (DA/100))/(BW)$$

Where:

$D_{\text{daily Dermal}}$	=	Daily absorbed dose (mg ai/kg/day) resulting from dermal exposure;
UE	=	Unit exposure (mg/lb ai handled) excerpted from PHED surrogate exposure table;
AR	=	Application rate (lb ai/acre) excerpted from available use information/labels, when certain hand devices were used (lb ai/acre) is replaced with (lb ai/gal);
A	=	Acres treated (acres/day) based on the amount that can be applied in a single day based on the application equipment type, when certain hand devices were used, (A/day) is replaced with (gal/day);
DA	=	Dermal absorption factor (%), if appropriate; and
BW	=	Body weight (kg) based on the body weight of an average adult human.

Daily inhalation dose is calculated using the following formula [Note: The same formula is applied regardless of the risk mitigation level. Only the unit exposure levels vary with different levels of risk mitigation.]:

$$D_{Daily\ Inhalation} = (UE \times (1\ mg/1000\ \mu g) \times AR \times A \times (IA/100))/(BW)$$

Where:

$D_{daily\ Inhalation}$	=	Daily absorbed dose (mg ai/kg/day) resulting from inhalation exposure;
UE	=	Unit exposure (mg/lb ai handled) excerpted from PHED surrogate exposure table, calculated using a standard inhalation rate of 29 liters/minute;
AR	=	Application rate (lb ai/acre) excerpted from available use information/labels, when certain hand devices were used (lb ai/acre) is replaced with (lb ai/gal);
A	=	Acres treated (acres/day) based on the amount that can be applied in a single day based on the application equipment type, when certain hand devices were used, (A/day) is replaced with (gal/day);
IA	=	Inhalation absorption (%); and
BW	=	Body weight (kg) based on the body weight of an average adult human.

v. Post-application exposures and assumptions

Post-application Exposure Scenarios

EPA has determined that postapplication exposure is likely following applications of dimethoate to fruit, vegetable, grain, fiber, feed, and ornamental crops as well as other sites during typical postapplication activities such as harvesting, scouting, pruning, and transplanting. The postapplication risk is based on the intermediate-term dermal toxicity endpoint only, since EPA estimates postapplication exposures to workers and crop advisors may exceed 7 days per year. For this risk assessment, the Agency is characterizing risk to (1) postapplication workers by the required duration of the restricted-entry interval (REI), and (2) crops advisors/scouts by the duration of the postapplication period during which personal protective equipment must be used.

Postapplication risks are mitigated for workers using a restricted-entry interval (REI). In general, the REI is established based on the number of days following application that must elapse before the pesticide residues dissipate to a level where estimated worker MOE's equal or exceed 300 while wearing baseline attire (i.e., long-sleeve shirt, long pants, shoes, and socks). Under the Worker Protection Standard for Agricultural Pesticides (WPS) -- 40 CFR Part 170, entry to perform routine hand labor tasks is prohibited during the REI and personal protective equipment can not be considered as a risk reduction measure in establishing the REI. Postapplication risks are mitigated for crop advisors/scouts using entry restrictions, not restricted-entry intervals. Since under the

Worker Protection Standard for Agricultural Pesticides -- 40 CFR Part 170, crop advisors/scouts are defined as handlers, the Agency can permit such persons to enter treated areas to perform scouting tasks, provided they are using required personal protective equipment. In general, the entry restriction is established based on the number of days following application that must elapse before the pesticide residues dissipate to a level where estimated scout/crop advisor MOE's equal or exceed 300 while wearing baseline attire (i.e., long-sleeve shirt, long pants, shoes, and socks).

For the purpose of conducting this assessment, indicator crop groups/activities, and assumptions regarding application rates and dermal transfer coefficients for these crop groups were selected that are likely to be representative of postapplication exposures to dimethoate. Transfer coefficients (Tc) are used to relate the DFR values to activity patterns (e.g., harvesting, scouting, irrigating) to estimate potential human exposure. All postapplication activities are assessed in this RED using surrogate transfer coefficient values to estimate potential exposure levels for all crops to determine the number of days following application when target MOEs (i.e., 300) are reached, since no dermal exposure levels were monitored concurrently with the DFR levels in registrant submitted studies. The transfer coefficients used are listed in the policy issued by the Science Advisory Council for Exposure. The results of this assessment are provided in the *Risk from Postapplication Exposure* section below. Since a multitude of crops are treated with dimethoate, it is necessary to assess the exposure potential resulting from a variety of crop types and postapplication activities. These surrogate transfer coefficients are believed to represent a reasonable and reliable estimate of potential postapplication exposures. The following is a summary of transfer coefficients and use rates by crop used in the post-application assessment:

0.16 lb ai/A (Medium potential for dermal transfer) Peas: harvest (*hand*), stake/tie, scout, irrigate with transfer coefficient of 4,000.

0.25 lb ai/A (Low potential for dermal transfer) collards, kale, mustard greens, endive, escarole, head lettuce, leaf lettuce, spinach, Swiss chard, turnips: harvest (*hand*) with transfer coefficient of 2,500; scout, irrigate with transfer coefficient of 1,000.

0.33 lb/A (Medium potential for dermal transfer) peppers: harvest (*hand*), stake/tie, scout, irrigate with transfer coefficient of 4,000.

(Tree Fruit/Nut) cherries, pecans: all activities, e.g., harvest (*hand*), prune, prop, summer shake, rake, pole and pickup (*nuts*) with transfer coefficient of 10,000.

0.5 lb ai/A (Low potential for dermal transfer) broccoli, Brussels sprouts, cabbage, cauliflower, celery, alfalfa, sorghum: harvest (*hand*) with transfer coefficient of 2,500; scout, irrigate with transfer coefficient of 1,000.

(Medium potential for dermal transfer) melons, watermelons, lentils, soybeans: harvest (*hand*), stake/tie, scout, irrigate with transfer coefficient of 4,000.

(High potential for dermal transfer) field corn, tomatoes, beans (excluding cowpeas): harvest (*hand*) with transfer coefficient of 10,000; stake/tie, scout, irrigate with transfer coefficient of 4,000.

(Tree fruit) citrus (foliar applications), pears, apples: all activities, e.g., harvest (*hand*), prune, prop, summer shake, rake, pole and pickup (*nuts*) with transfer coefficient of 10,000.

(Tubers) potatoes: dig/harvest by hand with transfer coefficient of 10,000; sort, pack with transfer coefficient of 2,500.

Cotton, safflower: early season scouting with transfer coefficient of 1,000; late season scouting with transfer coefficient of 4,000.

0.67 lb ai/A (Low potential for dermal transfer) wheat: harvest with transfer coefficient of 2,500; scout, irrigate with transfer coefficient of 1,000.

2.0 lb ai/A Grapes: harvest, hand girdle, cane, tie, prune, thin, tip with transfer coefficient of 15,000 and irrigate with transfer coefficient of 4,000.

Herbaceous and woody ornamentals: cut/harvest, prune with transfer coefficient of 10,000 and irrigate with transfer coefficient of 4,000.

4.0 lb ai/A Herbaceous and woody ornamentals: cut/harvest, prune with transfer coefficient of 10,000 and irrigate with transfer coefficient of 4,000.

Data Sources and Assumptions for Scenarios Considered

Postapplication exposure data were required for dimethoate during the DCI in support of the reregistration process, since, at that time, one or more toxicological criteria had been triggered. The following postapplication studies dislodgeable foliar residue (DFR) studies were submitted by the registrant:

- *A Study to Determine the Degradation of Dimethoate and Dimethoxon Grape Foliage Treated With Cygon Systemic 25W for Grape Insect Control:* American Cyanamid Company Experiment No. 60903-71-B4-R (Cyanamid Report No. 72-000015); Issue Date 5/25/72; Author: R. Little.

In this study, the dissipation of dimethoate and dimethoxon (a.k.a. omethoate) from treated grape leaves was quantified after a seasonal application schedule. Two areas of a vineyard containing Thompson seedless grapes were treated in Reedley, California during the growing season of 1971. Two application schedules were followed, one at each site. In the first schedule, four applications were completed at weekly intervals while the second schedule involved three applications at 14 day intervals. Residue levels were monitored using two techniques that include a total residue extraction using methylene chloride and a dislodging procedure using an aqueous saline solution. Whole-leaf samples were collected. Surface areas were calculated on a per sample basis using a plot of the surface area to weight ratio of the grape leaves picked from the same vineyard. According to the report, "the calculated half-lives for the total residues of dimethoate and dimethoxon in the methylene chloride and saline phases were 2.1 and 1.5 days, respectively."

A review of this study was completed which can be identified by the following information:

- *Data Evaluation Record for Case GS0088/Chemical 035001, Dimethoate:* Authored by Peg Perreault of Dynamac, Inc./ Rockville, Maryland; Approved by Jim Adams of the Occupational and Residential Exposure Branch 10/5/87.

Based on historical standards, the study was deemed to be "scientifically sound" and was found as a source of "supplemental information towards the registration of dimethoate." One should consider, however, that during the review process several inadequacies were identified including: methylene chloride and saline were used for the dislodging process; the control samples were apparently contaminated with dimethoate residues; and no meteorological data were provided in the report. It should be noted that these deficiencies would not be considered acceptable by current data evaluation standards. This study should not be considered as an acceptable source of information for use in the dimethoate reregistration process.

- *MRID # 446903-02. Bookbinder, M.G. Dissipation of Dislodgeable Foliar Residues of Dimethoate (O,O-dimethyl S-[N-[methylcarbamoyl]methyl] phosphorodithioate) and its Metabolite Omethoate (O,O-dimethyl S-[2-(methylamino)-2-oxoehtyl] phorphorothioate) after Application of CLEAN CROP® DIMETHOATE 400 Insecticide to Tomato Plants. October, 1998.*

The study was conducted in three geographical locations: near Porterville in Tulare County, California; near Hobe Sound, Martin County, Florida; and near Germansville in Lehigh County, Pennsylvania. According to the 1998 Agricultural Statistics Handbook (NASS, USDA), as cited in the study report, the test states and adjacent states produced 78 percent of the 1997 U.S. tomato acreage. At each of the test sites, two plots were established. One plot, located upwind from the other, was left untreated and served as a control. The other plot was divided into 3 subplots. Sampling rows were selected to minimize edge effects and spray overlap. During the field trial, test plots were maintained according to normal regional practice for tomato culture. The test plots received 2 applications, 7 or 8 days apart, of CLEAN CROP® DIMETHOATE 400 insecticide. As prescribed on the label, the dimethoate was formulated as a 42.9 percent emulsifiable concentrate containing 4 lbs active ingredient (ai) per gallon. The dimethoate was applied at the maximum registered application rate for tomatoes of 0.5 lb ai/acre, using CO_2 powered backpack boom equipment at the Florida site, and tractor-mounted PTO-powered groundboom equipment at the California and Pennsylvania sites. The California test plots received furrow irrigation totaling 22 inches during the trial period, but no rainfall. The Florida sites received drip irrigation totaling 2.16

inches and rain on days 4, 11, 12, and 13 after the second application. No irrigation was applied to the Pennsylvania site, but rain was recorded on days 3, 4, 5, 6, 10, 11, 12, and 14 after the second application -- with a one-day high rainfall event of 2.2 inches on day 6 after the second application. Tomato DFR leaf-punch samples of approximately 400 cm^2 of surface (two-sided) were collected using a 1-inch diameter Birkestrand leaf punch sampler plots prior to each application, as soon as the spray had dried (Day 0), and on days 1, 2, 3, 5, 7, 10, 14, 21, 28, and 35 after the second application. Samples collected after 14 days after the second application were not analyzed, because residues had dropped to below the limit of quantification (LOQ) by that time. In summary, the study completed in support of the regulatory requirements for dimethoate mostly met the criteria contained in Subdivision K of the Pesticide Assessment Guidelines. The following major issue was noted: residue values were calculated even for samples with concentrations below the LOQ, which may have affected the half life calculations.

- *MRID # 446903-01. Bookbinder, M. G. Dissipation of Dislodgeable Foliar Residues of Dimethoate (O,O-dimethyl S-[N-[methylcarbamoyl]methyl] phosphorodithioate) and its Metabolite Omethoate (O,O-dimethyl S-[2-(methylamino)-2-oxoehtyl] phorphorothioate) after Application of CLEAN CROP® DIMETHOATE 400 Insecticide to Leaf Lettuce. October, 1998.*

The study was conducted in three geographical locations: near Porterville in Tulare County, California; near Hobe Sound in Martin County, Florida; and near Germansville in Lehigh County, Pennsylvania. According to the 1998 Agricultural Statistics Handbook (NASS, USDA), as cited in the study report, the test states and adjacent states produced 100 percent of the 1997 U.S. leaf lettuce crop. At each of the test sites, two plots were established. One plot was left untreated and served as a control. The other plot was divided into 3 subplots for leaf disc collection. Sampling rows were selected to minimize edge effects and spray overlap. The test plots received 2 applications, 7 or 8 days apart, of CLEAN CROP® DIMETHOATE 400 insecticide. The dimethoate was formulated as a 42.9 percent emulsifiable concentrate containing 4 lbs active ingredient (ai) per gallon. The dimethoate was applied at the maximum registered application rate of 0.25 lb ai/acre, using CO_2 powered backpack boom equipment at the Florida site, and tractor-mounted PTO-powered groundboom equipment at the California and Pennsylvania sites. Application equipment was calibrated prior to application. Leaf disk samples of approximately 400 cm^2 of surface (two-sided) were collected from both the control and test plots prior to each application, as soon as the spray had dried (Day 0), and on 1, 2, 3, 5, 7, 10, 14, 21, 28, and 35 days after the second application. Samples collected subsequent to 14 days after the second application were not analyzed, because residues had dropped to below the limit of quantification (LOQ) by that time. Daily rainfall data were obtained onsite. ;Rainfall at the Florida and Pennsylvania sites during the sampling period totaled approximately 160 and 130% respectively of the 10 year regional precipitation avenge for the trial period. The California site received no rainfall during the study period. In summary, this DFR study completed in support of the regulatory requirements for Dimethoate met most of the criteria contained in Subdivision K of the Pesticide Assessment Guidelines. In addition, some discrepancy and minor issues were noted in this review.

- *MRID # 448276-01. Prochaska, Lee M. Dissipation of Dimethoate and its Metabolite Omethoate Dislodgeable Foliar Residues on Apples Treated with CLEAN CROP® DIMETHOATE 400 - Phase I: Field Investigation and Phase 2: Analytical. May 4, 1999.*

Clean Crop® Dimethoate 400 was applied using airblast sprayers twice during the growing season in August to apple trees in three locations. An application rate of 1.0 lb. active ingredient/ Acre (a.i./A) was employed. Application equipment was calibrated prior to application. Foliage samples were collected as soon as sprays had dried (e.g., no later than 4 hours post-application), 12 hours, 1, 2, 3, 5, 7, 10, 14, 21, 28, and 35 days after the last application. The first study site was in Ottawa County, near Marne, Michigan; the second was in upstate New York, in Wayne County near Alton, NY; and the third site was in the Washington State central valley, in Grant County, near Ephrata, WA. In 1997, the top three U.S. apple-producing states were Washington, Michigan, and New York; these states together produced 69 percent of the total U.S. crop (USDA, Agricultural Statistics, 1997). Historical meteorological conditions at the three sites seem to indicate nearly normal conditions in these areas at the time of the study. There was no rainfall within 24 hours before or after application. Irrigation was applied to the plots in Washington State on the fifth day after application. Cheminova analyzed the dissipation data using a nonlinear regression fit to a first order decay equation. Combined dimethoate and omethoate were reanalyzed using linear regression of log transformed data. Residues were still detectable 35 days after the application at all locations. The study met most of the requirements of the Environmental Protection Agency's (US-EPA) OPPTS Series 875, Occupational and Residential Exposure Test Guidelines, Group B: Postapplication Exposure Monitoring Test Guidelines. The major deviation was that the study was conducted using an application rate of 1.0 lb ai/acre as opposed to the label specified maximum application rate of 0.5 lb ai/acre.

- *MRID No. 447882-01. Prochaska, Lee M. Dissipation of Dimethoate and its Metabolite Omethoate Dislodgeable Foliar Residues on Grapes Treated with Clean Crop® Dimethoate 400, Phase I Field Investigation & Phase II Analytical,*

The study was conducted in three geographical locations: in the California Central Valley, near Porterville, in Tulare County; in upstate New York, near Dundee, in Yates County; and in the Washington State central valley, 8 miles south of Quincy, in Grant County. At each of the test sites, two plots were established. One plot was left untreated and served as a control. The other plot was divided into 3 subplots for leaf disc collection. Sampling rows were selected to minimize edge effects and spray overlap. Clean Crop® Dimethoate 400 was applied to the vineyards twice during the growing season from a few days to a month after "veraison," which is the point at which the grape enters the ripening period (i.e., "green" to mature fruit). Both applications were applied at 1 lb ai/A, not the label permitted maximum rate of 2 lbs ai/A. Airblast sprayers were used at all test sites. No rain events are noted in California; irrigation occurred three times (4 inches each time); these did not coincide with pesticide applications. In New York, there were 16 rain events; these did not coincide with pesticide applications. In Washington, there were 10 rain events and two irrigation events; these did not coincide with pesticide applications. Foliage samples were collected as soon as sprays had dried (e.g., no later than 4 hours post-application), 12 hours, 1, 2, 3, 5, 7, 10, 14, 21, 28, and 35 days after the last application. When dimethoate and omethate dislodgeable foliar residues were combined, levels were detectable through day 35 at the WA and CA sites. Combined levels had fallen to < LOQ after day 14 at the NY site. Using linear regression - Microsoft EXCEL 97® combined dimethoate and omethoate DFR half-lives were: California - 4.7 days (R^2 = 0.84); Washington State - 4.92 days (R^2 = 0.86); and New York - 1.55 days (R^2 = 0.94). Cheminova estimates for dimethoate half-lives were: California - 0.4 days (R^2 = 0.98); Washington State - 1.33 days (R^2 = 0.97); and New York - 0.85 days (R^2 = 0.97). Cheminova estimates for omethoate half-lives were: California - 10.8 days (R^2 = 0.92); Washington State - 18.2 days (R^2 = 0.93); and New York - 5.3 days (R^2 = 0.93). This study met most of the OPPTS Series 875 Group B Occupational and Residential Exposure Test Guidelines. The most important deviation was that the study was not conducted at the maximum application rate.

Postapplication Exposures for Other Crops

EPA had no dimethoate-specific data for the crops other than lettuce, grapes, tomatoes, and apples. Therefore, a surrogate postapplication exposure risk assessment was conducted for the other crops using one of the three studies submitted.

The apple data were used in the postapplication assessment for all tree fruit and nut crops, and woody ornamentals.

The grape data were used in the postapplication assessment just for grapes.

The lettuce data (MRID 446903-01) were used for crops with an application rate of 0.25 lb ai/acre and less, since the data represent DFR levels obtained at an application rate of 0.25 lb ai/acre. For applications to peas, the predicted DFR levels ($\mu g/cm^2$) based on the slope and intercept were normalized (see equation in Exposure and Risk Calculation section below) to account for a potential decrease in residues when dimethoate is applied at the application rate of 0.16 lb ai/acre. These data were used to assess postapplication risks (see Appendix G-3) from contact with:

- peas at an application rate of 0.16 lb ai/acre and assessed for hand harvesting, staking/tying, scouting, irrigating (transfer coefficient = 4,000);
- collards, kale, mustard greens, endive, escarole, head lettuce, leaf lettuce, spinach, Swiss chard, and turnips at an application rate of 0.25 lb ai/acre and assessed for hand harvesting (transfer coefficient = 2,500) and scouting or irrigating (transfer coefficient = 1,000).

The tomato data (MRID446903-02) were used for crops other than grapes with an application rate ranging from 0.33 lb ai/acre and higher (except tree and woody crops), since the data represent non-woody plants and DFR levels were obtained at an application rate of 0.5 lb ai/acre. For applications other than at the 0.5 lb ai/acre rate, the predicted DFR levels ($\mu g/cm^2$) based on the slope and intercept were then normalized to account for a potential increase/decrease in residues when dimethoate is applied at application rates ranging from 0.33 lb ai/acre to 4 lb ai/acre (e.g., DFR levels were multiplied by two to approximate the residues at 1.0 lb ai/acre). These data were used to assess postapplication risks (see Appendix G-4) from contact with:

- peppers at an application rate of 0.33 lb ai/acre and assessed for hand harvesting, staking/tying, scouting, irrigating (transfer coefficient = 4,000);
- broccoli, Brussels sprouts, cabbage, cauliflower, celery, alfalfa, and sorghum at an application rate of 0.5 lb ai/acre and assessed for hand harvesting (transfer coefficient = 2,500) and scouting or irrigating (transfer coefficient = 1,000).
- melons, watermelons, lentils, soybeans at an application rate of 0.5 lb ai/acre and assessed for hand harvesting, staking/tying, scouting, irrigating (transfer coefficient = 4,000);
- field corn, tomatoes, beans (excluding cowpeas) at an application rate of 0.5 lb ai/acre and assessed for hand harvesting (transfer coefficient = 10,000) and staking/tying, scouting, irrigating (transfer coefficient 4,000);
- potatoes at an application rate of 0.5 lb ai/acre and assessed for hand digging/harvesting (transfer coefficient = 10,000) and sorting, packing (transfer coefficient = 2,500);
- cotton, safflower at an application rate of 0.5 lb ai/acre and assessed for hoeing/late season scouting (transfer coefficient = 4,000) and early season scouting (transfer coefficient = 1,000);
- wheat at an application rate of 0.67 lb ai/acre and assessed for harvesting (transfer coefficient = 2,500) and scouting, irrigating (transfer coefficient = 1,000); and
- herbaceous ornamentals at an application rate of 2.0 and 4.0 lb ai/acre and assessed for cutting/harvesting, pruning (transfer coefficient = 10,000) and irrigating (transfer coefficient = 4,000).

The grape data were used in the postapplication assessment for just grape crops (see Appendix G-5). The grape data (MRID 447882-01) represent DFR levels obtained at an application rate of 1.0 lb ai/acre. The predicted DFR levels ($\mu g/cm^2$) based on the slope and intercept were then normalized to account for a potential increase in residues when dimethoate is applied at the application rate of 2.0 lb ai/acre.

The apple data were used in the postapplication assessment for all tree fruit and nut crops, and woody ornamentals. The apple data (MRID 448276-01) represent DFR levels obtained at an application rate of 1.0 lb ai/acre. The predicted DFR levels ($\mu g/cm^2$) based on the slope and intercept were then normalized to account for a potential increase in residues when dimethoate is applied at the application rate of 2.0 and 4.0 lb ai/acre, and for potential decrease in residues when dimethoate is applied at the application rate of 0.33 lb ai/acre and 0.5 lb ai/acre. These data were used to assess postapplication risks (see Appendix G-6) from contact with:

- cherries, pecans at an application rate of 0.33 lb ai/acre and assessed for hand harvesting, pruning, propping, harvesting nuts by shaking, raking, poling, and pickup, and all other activities (transfer coefficient = 10,000);
- citrus (tree fruit-foliar applications), pears, apples at an application rate of 0.5 lb ai/acre and assessed for hand harvesting, pruning, propping, harvesting nuts by shaking, raking, poling, and pickup, and all other activities (transfer coefficient = 10,000); and

- woody ornamentals at an application rate of 2.0 and 4.0 lb ai/acre and assessed for cutting/harvesting, pruning (transfer coefficient = 10,000) and irrigating (transfer coefficient = 4,000).

Post-application Exposure and Risk Calculations

When the application rate of the crops being assessed for postapplication risk differs from the application rate used in the surrogate crop DFR study, the dimethoate-specific DFR data were normalized using the following formula:

$$DFR_{(norm)} = DFR_{(study)} \ x \ \frac{application \ rate_{(norm)}}{application \ rate_{(study)}}$$

The calculation of daily exposure to dimethoate by persons entering the treated area after application is used to assess the risk to those persons. The average daily dermal dose is calculated using the following formula:

$$Dermal \ Dose \ (mg/kg/day) = \frac{(DFR \ (mg/cm^2) \ x \ Tc \ (cm^2/hr) \ x \ Abs \ (0.11) \ x \ ED \ (8hrs/day))}{BW} \ (70kg)$$

and MOE is calculated using the following formula:

$$Total \ MOE = \frac{LOAEL \left(\frac{mg}{kg/day}\right)}{Average \ Daily \ Dermal \ Dose \left(\frac{mg}{kg/day}\right)}$$

where: intermediate-term dermal LOAEL = 3.2 mg/kg/day and UF = 300.

The residues for dimethoate and omethoate (the oxon formed by dimethoate) were combined to obtain a total residue value for the three studies used for the assessment. For both the tomato and lettuce studies the residue levels (i.e., combined dimethoate and omethoate values) and dissipation rates at the California sites were significantly different from those at the Florida and Pennsylvania sites. Therefore, the results are reported for all three sites separately. The results for all three sites are also reported for the apple and grape studies.

Whenever feasible, EPA prefers to use the actual data reported in a chemical-specific study, rather than using a regression analysis to predict residue levels. Typically, postapplication studies initially collect data daily (i.e., days 0, 1, 2, and 3) and thereafter collect data at intervals (i.e., days

5, 7, 10, 14, 21). If residues dissipate below EPA's level of concern during the time period when data are collected daily, EPA prefers to use the actual data reported in a chemical-specific study to assess postapplication risks. However, if residues remain a concern beyond the period of daily data collection, EPA uses a regression analysis to predict residue levels for those days where data are not collected. Since residues dissipated to a level not of concern within the time period where the tomato and lettuce studies reported residue data each day, actual data were used to assess postapplication exposures for all crops for which these studies were used. However, since residues were of concern for the apple and grape studies beyond the point were daily residue data were being gathered, a regression analysis was conducted using the natural log-transformed DFR data from each test site using the following equation:

$$y = mx + b$$

where:

x	=	days postapplication;
m	=	slope of the regression line;
b	=	constant; and
y	=	residue on day x.

The linear regression parameters from the grape and apple studies are described in Appendix G-1. The actual DFR data can be found in the EPA review of the respective studies. The table in Appendix G-2 lists the predicted residue values determined using natural log transformed DFR data after the last dimethoate application and the y = mx + b formula.

b. Occupational and Residential Risk Assessment/Characterization

i. Methods For Calculating Risks from Dermal/Inhalation Exposures

The calculations of the daily dermal and inhalation dose of dimethoate received by handlers are used to assess the dermal and inhalation risks to those handlers. Short-term and intermediate-term MOEs, regardless of the exposure scenario, were calculated using the following formula:

$$MOE = NOAEL\ (mg/kg/day)/Dose_{Dermal\ or\ Inhalation}\ (mg/kg/day)$$

In addition, since the endpoints of concern for dermal and inhalation routes were based on identical adverse effects (i.e., cholinesterase inhibition) the risks are aggregated. For short-term risks, the uncertainty factor for both dermal and inhalation risk is 100, whereas for intermediate-term risks, the uncertainty factor for both dermal and inhalation risk is 300. Therefore, the total risk can be calculated as follows:

$$\text{Total MOE} = \frac{1}{\frac{1}{\text{dermal MOE}} + \frac{1}{\text{inhalation MOE}}}$$

The calculations used to estimate *Daily Dose* and *MOE* for the post-application scenarios are similar. The only significant difference is the manner in which the *Daily Dose* will be calculated using a transfer coefficient, transferable residue levels, and accounting for the dissipation of dimethoate over time. *Daily Dose* and *MOE* values are calculated for each postapplication day until a restricted-entry interval is achieved based on the MOE value in occupational settings (i.e., REIs are based on MOE values $\geq$ 300).

ii. General Risk Characterization Considerations

Several issues must be considered when interpreting the occupational risk assessment. These include:

- No acceptable chemical-specific data for handlers were submitted. As a result, all analyses were completed using surrogate data from sources such as PHED.

- Several handler assessments were completed using “low quality” PHED data due to the lack of a more acceptable dataset (see Appendix F for further details).

- Several generic protection factors were used to calculate handler exposures. The protection factors used for clothing layers and gloves have not been completely evaluated by EPA. The key element being evaluated by EPA is the factor for clothing. The value used for respiratory protection is based on the *NIOSH Respirator Decision Logic*.

- Various exposure factors used in the calculations (e.g., acres treated per day for each application method) are based on the best professional judgement of EPA due to a lack of extensive pertinent data.

- Exposure descriptors have not been assigned to each scenario that has been assessed because the data to describe distributions for each exposure factor are not available. The PHED surrogate exposure values can be described in terms, however, as values that are generally between the geometric mean and the median of the dataset used for calculation of the value. Calculations were completed for a variety of maximum application rates that varied based on crop type for each handler/equipment scenario assessed. No specific data were available pertaining to typical rates was available. However, an assessment was completed *de facto* because of the large range of application rates assessed for each scenario. Additionally, as indicated above, the area treated values were based on the best-professional judgement of EPA. These values, however, are believed to represent typical to high-end acreages and volumes.

Refinement of the EPA exposure and risk assessment calculations presented in this chapter is possible if the issues presented above are addressed by the registrant or if more refined approaches and data become available to EPA.

iii. Total Risks to Occupational Handlers

Dermal, inhalation, and total risks for occupational handlers were assessed using the short-term and intermediate-term toxicological endpoints. Results from the assessment are presented below (i.e., short and intermediate-term assessment). A chronic risk assessment was not completed as EPA believes that dimethoate use patterns do not lend themselves to chronic exposure scenarios.

EPA identified exposure scenarios based on available labels and other use information, such as the LUIS report. As indicated above in section 4.a, surrogate data were used to develop the exposure/risk assessment for occupational handlers. In some cases, appropriate surrogate data were not available to serve as the basis for an assessment. The scenarios for which no appropriate data are available are presented below:

- (4) Application of liquids with helicopter aircraft (Note: scenario (3) applying liquids with aircraft is used as a surrogate);

- (8) Application of ready-to-use liquids;

- (10) Application via soil injection for ornamental cultivation purposes;

- (14) Application via sprinkler can; and

- (15) Soil drench application.

iv. Short- and Intermediate-Term Occupational Handler Risks

The calculations of short- and intermediate-term total risks to handlers indicate that the MOEs are a concern:

- even with the use of engineering controls at the 4.0 pound per acre application rates (ornamentals) for:
  - -- mixing/loading liquids to support aerial applications (short-term total MOE = 55 with an uncertainty factor (UF) of 100; intermediate-term total MOE = 160 with a UF of 300),
  - -- applying aerially (short-term total MOE = 94 with a UF of 100; intermediate-term total MOE = 260 with a UF of 300), and
  - -- flagging (short-term total MOE = 96 with a UF of 100; intermediate-term total MOE = 270 with a UF of 300);

- even with the use of engineering controls at the 2.0 pound per acre application rates (grapes) for mixing/loading wettable powders to support aerial applications (short-term total MOE = 91 with a UF of 100; intermediate-term total MOE = 240 with a UF of 300);

- even with the use of maximum personal protective equipment, including chemical-resistant gloves, double-layer body protection, and a dust-mist respirator, for mixing, loading, and applying with a high-pressure handwand sprayer on ornamentals at application rates ranging from:
  - -- 0.1 lb ai/gal (short-term total MOE = 4.1 with a UF of 100; intermediate-term total MOE = 11 with a UF of 300),
  - -- 0.6 lb ai/gal (ornamentals) (short-term total MOE = 6.8 with a UF of 100; intermediate-term total MOE = 19 with a UF of 300), and
  - -- to 0.01 lb ai/gal (ornamentals) (short-term total MOE = 41 with a UF of 100; intermediate-term total MOE = 110 with a UF of 300).

  No engineering controls are currently available for this scenario.

- even with the use of maximum personal protective equipment, including chemical-resistant gloves, double-layer body protection, for applying liquids with a paintbrush to agricultural-animal and poultry industry premises at 2 lb ai/gal (short-term total MOE = 7.5 with a UF of 100; intermediate-term total MOE = 21 with a UF of 300). No engineering controls are currently available for this scenario.

The following table summarizes the risks to handlers by crop type and application rate. The application rate is the *proposed* maximum application rate for each crop as submitted by a registrant.

TABLE 1: SUMMARY OF HANDLER RISKS FOR DIMETHOATE BY CROP TYPE

NOTE: Application Rate = maximum application rate for the crop based on *proposed* maximum rates submitted by a registrant.

CROP	HANDLER SCENARIO	APPLICATION RATE	BASELINE TOTAL MOE		ADDITIONAL PPE TOTAL MOE		ENGINEERING CONTROLS TOTAL MOE	
			Short-T UF=100	Inter.-T UF=300	Short-T UF=100	Inter.-T UF=300	Short-T UF=100	Inter.-T UF=300
Grapes	Mixing/loading wettable powder for aerial and chemigation applications	2.0 lb ai/A (proposed)	0.26	0.71	5.8 g,dl,r	14 g,dl,r	91 g	240 g
	Aerial spray applications	2.0 lb ai/A (proposed)	no data	no data	no data	no data	190	520
	Flagging for aerial spray	2.0 lb ai/A (proposed)	78	210	85 dl	220 dl	190	540
	Mixing/loading wettable powders for groundboom	2.0 lb ai/A (proposed)	1.1	3.1	25 g,dl,r	61 g, dl, r	400 g	1100 g
	Groundboom application	2.0 lb ai/A (proposed)	250	610	NA	NA	NA	NA
	Mixing/loading wettable powders for airblast	2.0 lb ai/A (proposed)	2.2	6.2	51 g, dl, r	120 g,dl,r	800 g	2100 g
	Airblast application	2.0 lb ai/A (proposed)	23	63	36 g,dl	98 g,dl	210	550

g = gloves
dl = coveralls worn over long-sleeve shirt and long pants
r = respirator. When no r appears in the MOE column, values reflect MOEs without respirator.

SUMMARY OF HANDLER RISKS FOR DIMETHOATE BY CROP TYPE (continued)

CROP	HANDLER SCENARIO	APPLICATION RATE	BASELINE TOTAL MOE		ADDITIONAL PPE TOTAL MOE		ENGINEERING CONTROLS TOTAL MOE	
			Short-T UF=100	Inter.-T UF=300	Short-T UF=100	Inter.-T UF=300	Short-T UF=100	Inter.-T UF=300
Citrus	Mixing/loading liquids for aerial and chemigation applications	2.0 lb ai/A (current)	0.34	1	55 g,dl,r	150 g,dl,r	110 g	310 g
		0.5 lb ai/A (proposed)	1.4	4	140 g	340 g	NA	NA
	Aerial spray applications	2.0 lb ai/A (current)	no data	no data	no data	no data	190	520
		0.5 lb ai/A (proposed)	no data	no data	no data	no data	750	2100
	Flagging for aerial spray	2.0 lb ai/A (current)	78	210	85 dl	220 dl	190	540
		0.5 lb ai/A (proposed)	310	820	NA	NA	NA	NA
	Mixing/loading liquids for airblast	2.0 lb ai/A (current)	3	8.7	300 g	750 g	NA	NA
		0.5 lb ai/A (proposed)	12	35	1200 g	3000 g	NA	NA
	Airblast application	2.0 lb ai/A (current)	23	63	36 g,dl	98 g,dl	410	1100
		0.5 lb ai/A	92	250	130 g	360 g	NA	NA
Wheat	Mixing/loading liquids for aerial and chemigation applications	0.67	1	3	100 g	310 g,dl	NA	NA
	Aerial spray applications		no data	no data	no data	no data	560	1500
	Flagging for aerial spray		230	610	NA	NA	NA	NA
	Mixing/loading liquids for groundboom		4.5	13	450 g	1100 g	NA	NA
	Groundboom application		740	1800	NA	NA	NA	NA

g = gloves
dl = coveralls worn over long-sleeve shirt and long pants
r = respirator. When no r appears in the MOE column, values reflect MOEs without respirator.

SUMMARY OF HANDLER RISKS FOR DIMETHOATE BY CROP TYPE (continued)

CROP	HANDLER SCENARIO	APPLICATION RATE	BASELINE TOTAL MOE		ADDITIONAL PPE TOTAL MOE		ENGINEERING CONTROLS TOTAL MOE	
			Short-T UF=100	Inter.-T UF=300	Short-T UF=100	Inter.-T UF=300	Short-T UF=100	Inter.-T UF=300
Broccoli, cabbage, cauliflower, field corn, sorghum, melons, watermelons, tomatoes, beans, lentils, soybeans, celery, alfalfa, potatoes, cotton, and safflower	Mixing/loading liquids for aerial and chemigation applications	0.5 lb ai/A	1.4	4	140 g	340 g	NA	NA
	Aerial spray applications		no data	no data	no data	no data	750	2100
	Flagging for aerial spray		310	820	NA	NA	NA	NA
	Mixing/loading liquids for groundboom		6	17	600 g	1500 g	NA	NA
	Groundboom application		990	2500	NA	NA	NA	NA
Tree fruit & nuts (pears & apples at maximum of 0.5 lb ai/A and cherries & pecans at maximum of 0.33 lb ai/A)	Mixing/loading liquids for aerial and chemigation applications	0.5 lb ai/A	1.4	4	140 g	340 g	NA	NA
		0.33 lb ai/A	2.1	6.1	210 g	520 g	NA	NA
	Aerial spray applications	0.5 lb ai/A	no data	no data	no data	no data	750	2100
		0.33 lb ai/A	no data	no data	no data	no data	1100	3100
	Flagging for aerial spray	0.5 lb ai/A	310	820	NA	NA	NA	NA
		0.33 lb ai/A	480	1200	NA	NA	NA	NA
	Mixing/loading liquids for airblast	0.5 lb ai/A	12	35	1200 g	3000 g	NA	NA
		0.33 lb ai/A	18	53	1800 g	4500 g	NA	NA
	Airblast application	0.5 lb ai/A	92	250	130 g	360 g	NA	NA
		0.33 lb ai/A	140	380	NA	NA	NA	NA

g = gloves
dl = coveralls worn over long-sleeve shirt and long pants
r = respirator. When no r appears in the MOE column, values reflect MOEs without respirator.

SUMMARY OF HANDLER RISKS FOR DIMETHOATE BY CROP TYPE (continued)

CROP	HANDLER SCENARIO	APPLICATION RATE	BASELINE TOTAL MOE		ADDITIONAL PPE TOTAL MOE		ENGINEERING CONTROLS TOTAL MOE	
			Short-T UF=100	Inter.-T UF=300	Short-T UF=100	Inter.-T UF=300	Short-T UF=100	Inter.-T UF=300
Peppers	Mixing/loading liquids for aerial and chemigation applications	0.33 lb ai/A	2.1	6.1	210 g	520 g	NA	NA
	Aerial spray applications		no data	no data	no data	no data	1100	3100
	Flagging for aerial spray		480	1200	NA	NA	NA	NA
	Mixing/loading liquids for groundboom		9.1	26	910 g	2300 g	NA	NA
	Groundboom application		1500	3700	NA	NA	NA	NA
Collards, kale, mustard greens, endive (escarole), head lettuce, leaf lettuce, spinach, Swiss chard, and turnips	Mixing/loading liquids for aerial and chemigation applications	0.25	2.8	8	280 g	690 g	NA	NA
	Aerial spray applications		no data	no data	no data	no data	1500	4100
	Flagging for aerial spray		630	1600	NA	NA	NA	NA
	Mixing/loading liquids for groundboom		12	35	1200 g	3000 g	NA	NA
	Groundboom application		200	4900	NA	NA	NA	NA
Peas	Mixing/loading liquids for aerial and chemigation applications	0.16 lb ai/A	4.3	12	430 g	1100 g	NA	NA
	Aerial spray applications		no data	no data	no data	no data	2300	6500
	Flagging for aerial spray		980	2600	NA	NA	NA	NA
	Mixing/loading liquids for groundboom		19	55	1900 g	4700 g	NA	NA
	Groundboom application		3100	7700	NA	NA	NA	NA

g = gloves
dl = coveralls worn over long-sleeve shirt and long pants
r = respirator. When no r appears in the MOE column, values reflect MOEs without respirator.

SUMMARY OF HANDLER RISKS FOR DIMETHOATE BY CROP TYPE (continued)

CROP	HANDLER SCENARIO	APPLICATION RATE	BASELINE TOTAL MOE		ADDITIONAL PPE TOTAL MOE		ENGINEERING CONTROLS TOTAL MOE	
			Short-T UF=100	Inter.-T UF=300	Short-T UF=100	Inter.-T UF=300	Short-T UF=100	Inter.-T UF=300
Ornamentals	Mixing/loading liquids for aerial and chemigation applications	4.0 lb ai/A	0.17	0.5	27 g,dl,r	76 g,dl,r	55 g	160 g
		2.0 lb ai/A	0.34	1	55 g,dl,r	150 g,dl,r	110 g	310 g
	Aerial spray applications	4.0 lb ai/A	no data	no data	no data	no data	94	240
		2.0 lb ai/A	no data	no data	no data	no data	400	1100
	Flagging for aerial spray	4.0 lb ai/A	39	100	48 dl,r 43 dl	140 dl,r 110 dl	96	270
		2.0 lb ai/A	78	210	85 dl	220 dl	190	540
	Mixing/loading liquids for groundboom	4.0 lb ai/A	0.75	2.2	120 g,dl,r 95 g,dl	330 g,dl,r 230 g,dl	NA	NA
		2.0 lb ai/A	1.5	4.4	150 g	380 g	NA	NA
	Groundboom application	4.0 lb ai/A	120	310	NA	NA	NA	NA
		2.0 lb ai/A	250	610	NA	NA	NA	NA
	Mixing/loading liquids for airblast	4.0 lb ai/A	1.5	4.4	150 g	380 g	NA	NA
		2.0 lb ai/A	3.	8.7	300 g	750 g	NA	NA
	Airblast application	4.0 lb ai/A	11	32	18 g,dl	49 g,dl	210	550
		2.0 lb ai/A	23	63	36 g, dl	98 g,dl	410	1100

g = gloves
dl = coveralls worn over long-sleeve shirt and long pants
r = respirator. When no r appears in the MOE column, values reflect MOEs without respirator.

SUMMARY OF HANDLER RISKS FOR DIMETHOATE BY CROP TYPE (continued)

CROP	HANDLER SCENARIO	APPLICATION RATE	BASELINE TOTAL MOE		ADDITIONAL PPE TOTAL MOE		ENGINEERING CONTROLS TOTAL MOE	
			Short-T UF=100	Inter.-T UF=300	Short-T UF=100	Inter.-T UF=300	Short-T UF=100	Inter.-T UF=300
Ornamentals (continued)	Mixing/loading/applying with backpack and knapsack sprayers	0.1 lb ai/gal	No data	No data	110 g,dl,r 100 g,dl	310 g,dl,r 270 g,dl	NA	NA
		0.06 lb ai/gal	No data	No data	110 g	310 g	NA	NA
		0.01 lb ai/gal	No data	No data	660 g	1800 g	NA	NA
	Mixing/loading/applying with low pressure handwand sprayers	0.1 lb ai/gal	1.7	5.1	300 g	720 g	NA	NA
		0.06 lb ai/gal	2.9	8.5	500 g	1200 g	NA	NA
		0.01 lb ai/gal	17	51	3000 g	7200 g	NA	NA
	Mixing/loading/applying with high pressure handwand sprayers	0.1 lb ai/gal	No data	No data	4.1 g,dl,r	11 g,dl,r	None	None
		0.06 lb ai/gal	No data	No data	6.8 g,dl,r	19 g,dl,r	None	None
		0.01 lb ai/gal	No data	No data	41 g,dl,r	110 g,dl,r	None	None
Agricultural-animal premises and poultry industry	Mixing/loading/applying with backpack and knapsack sprayers	0.1 lb ai/gal	No data	No data	110 g,dl,r 100 g,dl	310 g,dl,r 270 g,dl	NA	NA
		0.06 lb ai/gal	No data	No data	110 g	310 g	NA	NA
		0.01 lb ai/gal	No data	No data	660 g	1800 g	NA	NA
	Mixing/loading/applying with low pressure handwand sprayers	0.1 lb ai/gal	1.7	5.1	300 g	720 g	NA	NA
		0.06 lb ai/gal	2.9	8.5	500 g	1200 g	NA	NA
		0.01 lb ai/gal	17	51	3000 g	7200 g	NA	NA
	Applying Liquids with a paintbrush	2 lb ai/gal	0.96	2.8	7.5 g,dl	21 g,dl	None	None
Rights-of-way	Mixing/loading wettable powders for rights-of-way	2.0 lb ai/A	8.9	25	100 g,dl 160 g,r	200 g,dl 410 g,r	NA	NA
	Applying to rights-of-way		27	76	110 g,dl	310 g,dl	NA	NA

g = gloves
dl = coveralls worn over long-sleeve shirt and long pants
r = respirator. When no r appears in the MOE column, values reflect MOEs without respirator.

v. Risk from post-application exposures

Post-application occupational exposure is likely following applications of dimethoate to fruit, vegetable, grain, fiber, feed, ornamental, and other crops and sites during typical post-application activities such as harvesting, scouting, pruning, and transplanting. The results of the risk assessment for postapplication exposures indicate that the location and/or the environmental conditions near the time of application influence the estimated restricted-entry interval as does the type of plant to which the application is directed.

- For non-woody food and feed crops, margins of exposure (MOEs) exceed 300 by the day after treatment (ranging from 12-24 hours) for study sites in Florida and Pennsylvania; whereas MOEs exceed 300 by 5 days after treatment (ranging from 12 hours to 5 days) in California. (See Appendix G-3 and G-4.)

- For non-woody ornamentals where the application rates are relatively high (2 to 4 pounds active ingredient per acre), MOEs exceed 300 by 5 days after treatment (ranging from 2 to 5 days) for study sites in Florida and Pennsylvania; whereas MOEs exceed 300 at >14 days after treatment (ranging from 7 to >14 days) in California. (See Appendis G-4.)

- For grape crops, MOEs exceed 300 by 9 days after treatment (ranging from 6-9 days) in New York, 17 days after treatment (ranging from 8-17 days) in California, and 23 days after treatment (ranging from 14-23 days) in Washington. (See Appendix G-5.)

- For woody food and feed crops (i.e., tree fruits/nuts), MOEs exceed 300 by Day 22 ranging from 12 to 22 days after treatment in New York and Michigan, whereas MOEs exceed 300 by 32 days after treatment (ranging from 27-32 days) in Washington. (See Appendix G-6.)

- For woody ornamentals where the application rates are relatively high (2 to 4 pounds active ingredient per acre), MOEs exceed 300 by 41 days after treatment (ranging from 18 to 41 days) for study sites in New York and Michigan; whereas MOEs exceed 300 by 60 days after treatment (ranging from 38 to 60 days) in Washington. (See Appendix G-6.)

vi. Incident reports

For a review of the pesticide poisoning incident data for dimethoate (Memorandum, 10/2/96), the Agency consulted the following data bases: (1) OPP Incident Data System (IDS); (2) Poison Control Centers (PCCs); (3) California Department of Food and Agriculture (replaced by the Department of Pesticide Regulation in 1991); and (4) National Pesticide Telecommunications Network (NPTN).

IDS. As of July 15, 1996, there were 23 reports involving dimethoate in IDS; 13 were received from California and may be included in the review of that data base. Nineteen of the 23 reports involved 79 humans. Of the remaining four reports, 3 involved environmental/ecological effects and one involved cattle.

Poison Control Center Data, 1985 - 1992. dimethoate was one of 28 chemicals for which Poison Control Center data were requested under a Data-Call-In issued in 1993. (Note: The 28 chemicals were selected on potential for acute risks to agricultural workers based on California poisoning incident data, California use/usage data, and toxicological data.) There were a total of 697 cases involving dimethoate in the PCC data base from 1985 through 1992. Of these, 194 cases were occupational exposures; 120 (62%) involved exposure to dimethoate alone and 74 (38%) involved exposure to multiple chemicals, including dimethoate. There was a total of 503 adult non-occupational exposures; 424 (84%) involved this chemical alone and 79 (16%) were attributed to multiple chemicals. For the analysis of this data, four measures of hazard were developed:

1. Percent of all accidental cases that were seen in or referred to a health care facility (HCF).
2. Percent of these cases (seen in or referred to HCF) that were admitted for medical care.
3. Percent of cases reporting symptoms based on just those cases where the medical outcome could be determined.
4. Percent of those cases that had a major medical outcome which could be defined as life-threatening or resulting in permanent disability.

Dimethoate ranked near the median for the 28 chemicals for all measures, whether used alone or in combination with other chemicals.

Another measure of risk which was used in this analysis was the ratio of systemic poisonings in agricultural workers in California per 1,000 applications of pesticide. Dimethoate ranked lower than the median for handlers but above the median for field workers, whether used alone or in combination with other chemicals.

A separate analysis was performed for exposures of children five years of age and under. For dimethoate, there were 110 incidents; 96 (87%) involved exposure to dimethoate alone, while 14 (13%) involved exposure to a combination of chemicals, including dimethoate. Using the same four measures of hazard as described above, dimethoate was comparable to the median of 17 pesticides reviewed.

The PCC data on children exposed to dimethoate were used to compare incidents to the amount of the chemical in U.S. homes in 1990, using both the number of containers and the number of applications as denominators. When using the number of applications, dimethoate was number two in a ranking of the top three (of 10) chemicals when evaluating exposures per use, poisonings per use, and health care referrals per use.

California Data, 1982 - 1993. Detailed descriptions of 493 cases submitted to the California Pesticide Illness Surveillance Program were reviewed. In 124 of these incidents, dimethoate was either used alone or in combination with other chemicals, but was judged to be responsible for the health effects. (Only cases with a definite, probable or possible relationship to dimethoate were reviewed.) The vast majority of the cases involved symptoms of systemic illness; gastrointestinal symptoms were reported in 72% of the 124 cases. Disability ranging from 1 to more than 10 days was reported in 27 of these cases; 5 persons were hospitalized. The activity categories most often associated with reports of illness were exposure to residual pesticide (following field, structural or other application) and drift (anyone exposed during the course of the application who was not involved in making the application). These two categories accounted for 75% of the systemic poisonings.

NPTN. Dimethoate was number 29 on NPTN's list of the top 200 active ingredients for which calls were received from 1984 through 1991. A total of 565 calls involved 201 incidents in 129 humans, 13 animals and 59 general inquiries.

vii. Data requirements

Short- and intermediate-term dermal and inhalation exposure assessments were made using PHED Version 1.1 surrogate data since no chemical-specific handler data were submitted. dimethoate-specific handler studies may be required pending the outcome of recommended discussions with the registrants and others on handler risk and risk mitigation.

Post-application exposure is likely following applications of dimethoate to fruit, vegetable, grain, fiber, feed, ornamental, and other crops and sites during typical post-application activities such as harvesting, scouting, pruning, transplanting, etc. Additional chemical-specific data, particularly data to allow calculation of a tranfer coefficient, from which to estimate post-application exposure to dimethoate may be required pending the outcome of discussions with registrants and others on postapplication risk and risk mitigation.